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INTRODUCTION

The Promise and Threat of New Technologies

Technology that could be used by schools to enhance the teaching and learning processes has been available for some time. Its effectiveness has been proved in research and demonstration and, more significantly, in continued application outside formal public education, such as in industry and military training. It is no secret, though, that regardless of proven and scattered examples of effective use, technology has not made a major impact on procedures in American public education.

This situation may change qualitatively because of a number of breakthroughs in microelectronics in recent years that have revolutionized information technology. With a decrease in size and cost, an "each-one-have-one" possibility is approaching reality. Already we have witnessed an unanticipated increase in the number of microcomputers in schools and in homes for storing information. In the area of information distribution (e.g., satellites, cable, data lines) a wider range of high quality information is becoming accessible. These changes will clearly have consequences for education, some of which will become apparent only through experience.

On the positive side, the classroom professionals will have more "control" over the selection and use of technology-supported materials for their students. The lack of this control has heretofore deterred widespread use of technology. Also the school, because it will increasingly have assurance of home techhnology resources, will be able to develop practical ways to support learning as a result of the home-school partnership rather than as a function of the school alone. On the negative side, the rapid spread of these newer technologies carries with it a potential for enlarging the body of students who are turned off and tuned out of American public education. (For example, teachers of children "educated" by Sesame Street in pre-school years report that these children have trouble adjusting to traditional information presentation methods when they enter school.)

A major consequence of the microelectronic revolution thus may be that education will soon lose the choice of "business-as-usual" (teaching without technology). In this case local practitioners and those who influence their continuing training and curriculum support must begin to adapt these new tools to their teaching and administrative needs.

In response to these developments the Division of Educational Technology, OLLT/OERI envisions a program of technical assistance and information resources for State Education Agencies to help them assist schools in their states in applying modern information technology to teach basic skills. Most significantly, the government recognizes that this technical assistance and materials dissemination must at the same time create a capability in the state to carry on the local support once this project ends. Thus it prescribes a technical assistance relationship built on a partnership between the states and the Federal Government.

Responding to the government's request, the Association for Educational Communications and Technology (AECT) in consortium with the Maryland Instructional Television (MITV) division of the Maryland State Department of Education and Applied Management Sciences (AMS) proposes a team, and assistance strategy, uniquely matched to the purposes of this contract and the conditions that will affect its implementation. Before presenting these particular strategies we want to discuss the outcomes that this approach can deliver, and the economic, political, and social conditions that make the strategy necessary. We purposefully start "at the end" because we believe that judgements on the success of this important Division of Educational Technology effort will be based more on its visible products and lasting effects on permanent educational services than on the particular methods used by the contractor.

Outcomes

Evidence of the success of this two year assistance project will be visible at three levels--the State Education Agency (SEA), the local education agency (LEA), and nationally.

At SEAs there will be:

- State curriculum supervisors in the basic skill areas--reading, mathematics and language arts who have had direct experience learning via technology about how they can use technology to accomplish their purposes.
- State supervisors who can, themselves, use technology appropriately to teach local school staffs.
- A core of new inservice instructional resources developed through this project that will include video formats appropriate to their situations, computer software and print materials. The state supervisory personnel will feel some sense of "ownership" in these

resources because they have been involved in their development; they will easily be able to fit them into credit and non-credit inservice training throughout the state.

- A functional working team consisting of specialists in the three basic skills curriculum areas (reading, mathematics, and language arts) and the state's media/technology staff, plus a strong possibility of a continuing relationship after the assistance contract ends.
- SEA basic skills staff using electronic mail systems to maintain regular acccess to and interaction with peers in other SEAs who are working with similar problems related to the applications of technology to teaching basic skills.
- The capability to maintain a state-based microcomputer software exchange for, at a minimum, the basic skills areas.
- An increased awareness of basic skills and technological resources related to their needs that are developed or being developed through other Division of Educational Technology/OERI (DET) contracts.

At LEAs there will be:

- Teachers, administrators and board members with an increased awareness of how the new information technologies relate to their particular concerns--an awareness developed from seeing practical demonstrations of what others are doing.
- Knowledge of how to get additional support--both information and human resources--to improve their present applications or to explore new ones.
- Continuing opportunities to interact with other practitioners with similar interests and to exchange resources.

At the national level there will be:

- Information resources and services (e.g., toll free telephone, exemplary software exchange, etc.) that can continue to be accessible to the field, without Federal government support, after the technical assistance project is completed.

Conditions that Influence the Assistance Strategy

The outcomes listed above can evolve in a variety of ways. The approach that the AECT consortium proposes is one that uniquely reflects our understanding of several fundamental conditions of the educational, political, social, and economic context in which we will work. These include:

1. How technology has been offered and communicated to educators over the years;
2. The present state of development and future potentials of the "newer" technologies such as microcomputers, videodiscs and the combination of the two in interactive video formats;
3. How decisions in education are made and supported at state and local levels;

4. The types of assistance most effective for developing the capacity of educational agencies;

The descriptions of each of these conditions (below) are derived from this contract consortium's direct experiences in the major content and procedural activities of this contract:

- teaching about technology;
- facilitating the exchange of current information about technology;
- developing mediated basic skills inservice and student instructional materials;
- providing technical assistance and dissemination services nationally.

The general approach in the following section describes how we will respond to each condition.

1. Communicating and Teaching about Technology. For almost two decades demonstrations and research have shown that various technological approaches and equipment could achieve educational results at least equal to traditional methods. That they have not been given the opportunity to produce these results on a regular and large scale basis may be attributed to two factors. First, "teachers teach the way they are taught" and most educational professionals have not had direct experience as learners with these tools. (What one knows about a medium from learning through it can be entirely different from what one knows when one's only experience is using it for teaching). Second, a major resource for communicating and teaching about technology applications has been research and demonstration. By definition, demonstrations and experiments usually require some isolation from the web of influences (economic, social, and political) that constrain the everyday processes of schooling. Thus while studies continue to find that technology can be effective, two decades of experience suggest that this effectiveness often cannot be maintained in the complex school environment and that technological approaches have seldom addressed the variety of practical problems that confront educational staff and decisionmakers. Other factors have also made it difficult for the educator to grasp fully the potentials of technology. Much of the information about technology focuses on what the technology can do. Yet communication research suggests that effective understanding begins with being able to perceive something in terms of one's own needs and experience. Recent National Science Foundation research on the acceptance of technology by schools and other human service organizations supports this:

> ...the effectiveness of the innovation usually had to be proved in practitioner terms--e.g., convenience, reduced physical effort, additional sense of safety on the job, greater potential for promotions, or elimination of distasteful tasks--which are different from the criteria typically used by external evaluators.[1]

What has been missing from communication and teaching about technology is a recognition that many decisions are influenced by the technology's consequences--personal, organizational and economic. The focus should be not only on what technology can do, but also on what technology can let the educator do (have free time for more direct student contact, attend meetings without burdensome time and travel costs). Thus, both technologists and educators are frustrated. The technologist knows the inherent potential of the technology and has seen them applied in commercial or consumer areas. The educator, on the other hand, does not deny the possibility of better ways to operate, but looks for someone who is willing to start the process where she or he is.

The curriculum materials and services developed under this contract must, therefore, represent not only an understanding of technology and of basic skills but must also be designed to communicate realistically to practitioners who face the everyday problems of running schools.

2. Present Status of Technology Development. The microelectronic revolution has made highly sophisticated technology economically feasible for most schools. Technological change, however, takes place at three levels--hardware, software, and applications. In the past we may have assumed that the easy availability of hardware would carry with it the development of high quality software and expanded educational utilization. That this has not happened in education suggests that each of these three aspects of the "revolution" needs to be considered separately.

Hardware

The large number of microcomputers now in schools was unanticipated. A panel of more than 150 experts (Nelles, 1980) projected that between 5000 & 8500 microcomputers would be in public schools by the end of 1980, but a recent (March 1981) NCES Fast Response Survey found more than 30,000 used for student instruction alone. The videodisc situation is a little different.

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[1] Yin, Robert K., "Life Histories of Innovations: How New Practices Become Routinized," Public Administration Review, January/February 1981.

The hardware itself is just entering the home market and is rapidly being accepted in the corporate training world. A recent market study (ITVA, 1980) predicted that real acceptance in the corporate and institutional market will not be achieved until 1985. The interactive videodisc, representing a combination of computer and video technologies, is also being accepted first by the worlds of business, military and continuing education.

Software

The growth of microcomputer hardware, however, has not been paralleled by a concomitant development of quality software or courseware. Commercial software developers did not see education as a viable market until there was sufficient hardware. Now that the hardware is appearing, commercial developers find that the ease by which programs can be copied and pirated still makes the venture risky. Thus, much of the software/courseware being used is home-grown. Some educational programs are being written by people who are not educators; some are being written by educators who lack good program analysis skills. In fact, the National Council of Teachers of Mathematics recently counseled its members to beware this "software jungle that users enter at their own risk."

The software for videodiscs, on the other hand, cannot be easily pirated, and is relatively inexpensive to reproduce from masters. (A 30-minute 16mm educational film that would cost $425 would sell for $280 on videotape and only $6 on videodisc.) Outside of the schools videodiscs are gaining great acceptance as alternatives for film and tape for training, communication and entertainment purposes. Competition for this growing and potentially lucrative market unfortunately directs producer attention away from an education market that appears insignificant by comparison. However, within months the National Education Association and the American Broadcasting Company will provide schools an educational "videodisc-of-the-month".

The highly promising area of interactive video presents another dimension of the software-courseware dilemna. It is not merely a recording or transmission format; it is an instructional methodology with vast implications for direct instruction. Unlike conventional video, interactive video is nonlinear. Its images are presented in an order determined by and appropriate to the learner's responses and needs. Because of this complexity it is fortunate that a number of government agencies are helping to support the development of interactive videodisc software (e.g., Division of Education Technology/OLLT, Office of Special Education, Corporation for Public Broadcasting, and the National Science Foundation).

Applications

One additional element of the present condition is relevant to the present state of technology. We noted earlier that few adults in education have had the experience of learning via the technologies they will use to help children learn. Even the "younger" professionals who may have been educated by the "new" technologies of the 1960s and 70s may not have experienced the highly interactive and individualized media available today. Thus they may not fully perceive the range of effective applications possible.

3. Decisions and Decisions about Technology. The contractor for this project has to negotiate agreements with separate states to commit their own resources and follow through on the purposes of this effort. Moreover, courseware must be designed to impact basic skills practitioners in the full range of local educational situations. To develop and maintain a system that will support these varying conditions and needs requires a sensitivity to how educational agencies at state and local levels operate, the factors that influence decisions, and in particular, how decisions to use technology are made.

Decisions to Participate

A letter of commitment from a Chief State School Officer is not the sole component of the agreement that will form the partnership between a state and this Federal effort. Of equal importance is the underlying commitment of those who will carry out the agreement--the SEA's professionals in basic skills and technology.

In this time of restricted resources any commitment of professional time and resources must be evaluated carefully. Both the Chief and the staff will have one basic concern: what will the benefits be for our state, how can involvement make us more effective? The politically astute Chief, recognizing that each curriculum specialist "represents" a constituency of practitioners, will check out the consequences of the decision with his/her staff. In many cases s/he will ask the staff to make a recommendation about participation in this program.

To obtain the state staff involvement that will ensure the desired outcomes of this contract, each "partnership agreement" should represent the culmination of thoughtful planning and not be just a one-person decision.

Basic Skills Coordination Decisions at the State Level

Traditionally education is managed as a fragmented enterprise. Each discipline functions practically as a self-contained unit. Different levels (e.g. elementary, secondary, higher education) seldom coordinate the learning pathways they construct for learners. Thus non-cooperation among curriculum areas at the SEA is not uncommon, especially when they may compete for the same budget dollar. Educational media and technology, though not comparable curriculum content areas, have also been affected by the history of fragmentation. Technology professionals have not been included in curriculum decisions, and many decisions have been seen as curriculum or technology rather than curriculum through (or because of) technology.

This situation has changed in recent years, thanks to a great extent to the Federal government. Title II (Basic Skills Improvement) of PL 95-561 has had a major influence on reorganization of the three communication and computational skills areas at the state level. This Federal commitment to a coordinated approach for improving basic skills teaching can be continued and reinforced through this assistance effort. Moreover, this contract can bring a new member to the team to enhance further the state's coordinated basic skills effort: the educational technology professional.

Decisions to Use Technology

A number of factors influence what otherwise might be simple purchase and application decisions.

An analysis of how technology has been applied in human service programs, conducted by Applied Management Sciences for the Office of the Secretary, DHEW,1/ noted that the decision to use technology is affected by several conditions. First is immediacy of need. In matters of health or safety, immediate results are often necessary. Similarly, technology can be justified in instructional situations outside the school (such as in industrial or military training) where it "pays" to achieve outcomes in the shortest possible time. In school, on the other hand, students usually complete terms, semesters, and years on a pre-established schedule, regardless of when specific learning "results" are achieved.

1/ Rhodes, L.; Report on Workshop on Use of Telecommunications for HEW Services, Applied Management Sciences, 1979.

Technology adoption is affected also by the number of realistic, available alternatives, each of which has certain strengths, weaknesses and consequences. The alternative chosen is often related to the consequences that come with it rather than the unique characteristics of the alternative itself.

Third, technology can make new outcomes possible[2/]. Advances in technology usually make it possible to achieve old objectives more efficiently and, if desired, to reach goals not possible before. Because the "old" goals and outcomes are firmly established as "givens," educators often overlook the potential of technology to achieve what they believed to be the "impossible dreams."

Another factor affecting the adoption of available technologies is costs, especially for technologies requiring widespread application to get economies of scale. These often require some form of cooperative planning and implementation among schools within an LEA and many times among LEAs. This form of collaboration is perceived as time-consuming and not easily maintained over long periods of time.

A fifth factor relates to the rapid rate of change in technology. The explosion of inventiveness that occurs until a market develops frequently produces noncompatible equipment (e.g. Beta, VHS video recorders) and makes it a risky proposition for a conscientious decision maker to spend public funds for equipment that may be outdated by more powerful or less expensive variations within a year or two. This factor also hampers attempts to share or develop software cooperatively, thus increasing the operating cost for each use.

Another set of "factors," some of which are symptoms of the above, relate to the structure of public education. These include:

[2/] This has been termed the "elevator phenomenon." When elevators were first invented they were put into three and four-story buildings. In these instances there was always a practical alternative available--the stairs. But the elevator made a new outcome--the skyscraper--possible and once these became standard, stairs (except for emergency use) were no longer a practical option. More immediate examples of this phenomenon in our own experiences are the telephone and the office copier. Each made it possible to operate organizations in ways that soon become standard. Today telephones and copying machines are basic "have-to-have" tools, not "nice-to-have" frills, and many organizations are currently undergoing this experience once more with word-processing and other microcomputer technologies.

- decentralization and departmentalization of LEAs/schools, which results in fragmented decision making and lack of systems planning;
- personnel management policies and bargaining agreements, which seldom include incentives for staff based on results and limit the hiring (or retention) of staff with the skills and expertise to use technology effectively;
- state accreditation on the basis of impacts (e.g., ratios) and subsequent funding formulae, which inhibit the funding of technology solutions;
- purchasing and budgeting conventions and practices.

In summary, if the assistance and materials provided by this contract are to be immediately useful and supportive of state and local needs, the contractor must understand and have direct experience working with state and local practitioners and, in particular, with technology applications and basic skills.

4. Technical Assistance for Capacity Building. Technical assistance is a term applied to a variety of strategies for providing resources to LEAs and SEAs. The direct experiences of the three members of this consortium as deliverers and receivers of assistance is our basis for defining technical assistance as "any resource provided by an outside agent to help an organization and its personnel accomplish their goals."

We know, however, that when technical assistance is provided as part of a Federal program several conditions can limit its effectiveness:

- Project length--by the time the local agency is ready to ask for help the project is over or has been discontinued with no provision for continuation of services.
- Assumption of needs--information and materials are prepared to meet needs as perceived by "others."
- Identification resources--frequently the clients for the assistance also have access to the resource most wanted by others--practical experience. Many TA systems provide local clients with access to experts, but not to each other.
- Scheduling of assistance to meet the service provider's needs--technical assistance is pre-scheduled and if the local agency does not want to lose the resource it has to accept it regardless of whether or not it is ready for it.

One result of situations like these is that LEAs and SEAs lose their trust in the assistance system and stop seeking help after the first try. To avoid this situation the technical assistance system developed to disseminate and provide the ongoing information services on this contract must:

a. have the capacity to be responsive to differing needs at differing times; and

b. use strategies that decrease dependency on the Federal contractor; build the capacity of the state and local agencies, and link them to peer agencies for continuing exchange and mutual support.

This concept of assistance has several implications for the desired outcomes of this contract. It requires that the services offered be related to the needs and wants felt by participating States. The curriculum and information services need to be perceived and planned as interrelated parts of a coordinated effort. They cannot be fragmented or one-shot endeavors. Finally, the information services need to be planned and implemented in a manner that will facilitate their continuance after the two-year contract period. Our strategies for accomplishing these objectives are presented in the General Approach section of Chapter 2.

Experience and Capabilities

To fulfill the government's purposes in light of the conditions discussed above, the Association for Educational Communications and Technology (AECT) has formed a working consortium with:

- the Maryland Instructional Television (MITV) division of the Maryland State Department of Education in association with the Maryland Center for Public Broadcasting and the National University Consortium;
- Applied Management Sciences (AMS), a nationally-known research, communications, and educational support organization.

What is most significant about this functional partnership is the creation of a base of complementary knowledge and experience in both the content of this contract--the teaching of basic skills and the application of technology to it, and also its processes--the production of national audio, video and audio-interactive teleconferences; the provision of capacity-building technical assistance; and the teaching about technology using technology.

The consortium members' experience and capabilities are addressed in more detail in a later section of the proposal, but we note here several key elements of organizational and staff experience that directly relate to the major tasks of this contract.

AECT is the professional association for people with a concern for technology and the experience of putting technology to work in instructional problem solving. Its members already are working, at all education levels, to provide instructional design and development of curricula, as well as facilitative support, for the classroom. On state, regional, national, and international levels, AECT's cooperative relationships with other organizations with common interests serve as an established network for soliciting assistance and disseminating information.

Exhibit 1.1 points to the association's long history of noteworthy endeavors in promulgating educational technology.

AECT's extensive experience in educational technology and its organizational liaisons situate it ideally for this project. AECT has the knowledge of technologies and methodologies central to the project, the organization to support its dissemination, and the people to serve as resources for its implementation.

Maryland Instructional Television brings to this effort direct experience in national teleconferences and in the production of basic skills curriculum materials for students and teachers. Its association and co-location with the Maryland Center for Public Broadcasting (MCPB) facilitate access both to PBS distribution systems and to the understanding of the problems of developing credit procedures amomg diverse institutions of higher education that reside in The National University Consortium. The placement of MITV within the State Education Agency provides additional sensitivity to the complex relationships necessary for the development of curriculum and technology partnerships at the state level. The Maryland Center for Public Broadcasting has been involved in teleconferencing and other telecommunications projects since 1976. Beginning with experimental two-way interconnects, MCPB has expanded its teleconferencing activities to the national level. One of the most recent was a two-hour teleconference for the National University Consortium featuring panelists from the University of Maryland and the Maryland Center for Public Broadcasting and funded through a Carnegie Corporation grant. The program simultaneously used two satellites (Westar I and Westar III) and intercut live segments from public television stations in Portland, Oregon, and University Park, Pennsylvania, as well as Owings Mills, Maryland. Viewers questioned the panelists during the second part of the program using direct telephone lines. Other teleconferences and clients served by the center are shown in Exhibit 1.2.

MITV is presently conducting a statewide school utilization survey modeled after Peter Dirr's 1977 CPB study.

Applied Management Sciences and its staff bring to this partnership their understanding and skills in the design and provision of technical assistance, school and state educational management procedures, technology applications in human services, and program evaluation.

AECT

For the Department of Education's Office of Special Education, AMS is currently providing dissemination, technical assistance and training to a network of regional resource centers serving State Education Agencies. This includes assistance in documenting promising ideas and practices. In another contract, AMS is assisting The National Center for Health Services Research to communicate in practical ways to local and state policy and decision makers. Last year AMS completed the design of a national technical assistance system for the Department of Education and the National Endowments for the Arts and the Humanities. This system to support arts education at state and local levels was built on a principle of collaboration and partnership similar to that required in this contract.

A recent contract with the Office of the Secretary, DHEW, required AMS to identify the barriers to the effective use of telecommunication technology in human service delivery and management. A workshop focusing on how to overcome these barriers was developed and implemented for Federal policy makers in education and other human service areas.

As a technology planner, AMS has assisted the Lister Hill National Center in developing a biomedical communications experiment using the communication technology satellite. In the area of educational use of technology AMS conducted a national survey of home viewership of ESAA-sponsored television series such as Villa Alegre, and recently completed a study of technology use in higher education for the Corporation for Public Broadcasting and the National Center for Education Statistics. AMS has had close liaison with community and local education agencies in a wide variety of evaluation studies and management assistance, including an assessment of the state agency component of the Right-to-Read Program. These studies, and others, have required the preparation of FEDAC/OMB clearance packages.

An example of how the understandings developed by the diverse studies and support services of an organization like AMS can be turned to immediate use can be found in this project's proposed information services strategy. AMS is currently conducting a study of 157 resource organizations for the office of the secretary DHHS. This study of public and private clearinghouses, exchanges, and networks is in direct response to questions raised by OMB as to duplication, overlap and competition of government-supported information services with the private sector. Knowledge of the concerns of the Executive Branch has helped shape our strategies to prevent duplication of effort and competition with the private sector.

Clearly, each partner in this consortium brings unique strengths plus an understanding of the others' roles necessary to make working relationships smooth and productive. If this were all that this partnership offered, the Division of Educational Technology would have no quarantee that the present work would profit from the organizations' combined experiences. The actual links to this base of knowledge and skills are the key staff members who will conduct the work of this contract, all of whom participated in the development of this proposal.

AECT brings important additional experience and linkages to the project through its Executive Director, Howard Hitchens. Since 1969 he has given stable leadership to the association and the field. He worked with the prestigious McMurrin Commission whose landmark report, To Improve Learning: An Evaluation of Instructional Technology, is the principal effort that the United States has supported in instructional technology. Dr. Hitchens serves also as current president of the Joint Council on Educational Telecommunication, an international consortium of education and related nonprofit, nongovernmental organizations promoting educational telecommunications. As an association executive he provides direct and personal linkage to other national and state associations that will play an important part in the proposal strategy.

The Project Director, Dr. Henry Ingle, has more than 15 years of experience in national and international information dissemination and communication programs in education and related human services. A former senior staff member of the National Institute of Education's Program on Information Dissemination and Communication, Dr. Ingle has worked directly with the key national and state organizations that will play a part in this endeavor. In 1979 he was selected for "Who's Who Among U.S. Hispanics."

Associate Project Director Lewis A. Rhodes is AMS's Director of Communications and Training. Former director of the Ford Foundation's National Project for the Improvement of Televised Instruction, he is a well-known consultant on dissemination, technical assistance and technology in human services management.

Associate Project Director for MITV is Dolores J. Deardorff. A former teacher and supervisor, Dr. Deardorff has also been director of a reading skills curriculum for a major city school system and design coordinator for five basic skills telecourses for classroom use and for two in-service telecourses distributed nationally. She currently serves as Branch Chief for Instructional Services within the Maryland State Department of Education.

Leroy J. London, who will play a major role in developing of the training materials to enhance the use of technology in teaching basic skills, has served as the Maryland State Department of Education's Right- to-Read Director, Basic Skills Coordinator, and Chief of the Basic Skills Branch. As a current member of the MITV staff he is involved in the development of a basic skills improvement telecourse designed to improve student competency in mathematics.

These key members of this contract's proposed management team provide a complete and comprehensive base of knowledge and experience necessary for this important effort. The value of starting from this base of experience will also be demonstrated by the approach and management schedule we propose on the following pages. The quantity of work that must be accomplished in a concentrated time at the beginning of this contract requires professionals who already have the experience to know what will work.